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A Study of the Genus Clastoptera

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PLATE II.

- Fig. 2. Enlarged view of the outside of the right valve and the inside of the left valve of a shell.
 Fig. 3. View of the animal with the right valve of the shell removed, and most of the right mantle lobe cut away.
 Fig. 4. Oblique cross-section of an animal through the intestinal coil and the pedal ganglia. Seen from behind.
 Fig. 5. Section through the heart in the same series as preceding.

PLATE III.

- Fig. 6. Cross-section of a piece of gill seen obliquely from the side so as to show both the section and the outer surface of a lamella.
 Fig. 7. Diagram of the outer, left, side of the left organ of Bojanus.
 Fig. 8. Section across an ovarian follicle.
 Fig. 9. Epithelial lining of the distal portion of the stomach.
 Fig. 10. Liver follicle showing charged and discharged cells.
 Fig. 11. Epithelial cells of the organ of Bojanus.

A STUDY OF THE GENUS *CLASTOPTERA*.

ELMER D. BALL.

In the development of the hind tibiae and the structure and venation of the wings, the insects under consideration represent the highest and most specialized forms of the *Cercopidæ* if not of the *Homoptera*; marking, as Uhler suggests, an important advance toward the *Heteroptera* in the increased freedom of the anterior coxæ and the possession of a terminal membrane to the corium.

In order to correctly establish generic characters it will be necessary, first, to separate off those of family value.

FAMILY *CERCOPIDÆ*.

The representatives of the family in this country, at least, agree in possessing the following characters:

Front inflated, convex or compresso produced; antennae inserted in front of and between the eyes; ocelli, two, situated on the disc of the vertex; thorax large, sexangular or trapezoidal; hemelytra coriaceous; posterior coxæ and femurs short, tibiae spatulate, armed with two spurs, the first once, the second twice as long as tibiae are wide; tibiae and two first joints of tarsi terminated with crescent-shaped rows of spines, third joint with a bifid claw.

The following genera are represented in the United States: *Monecphora*, *Lepyronia*, *Aphrophora*, *Philaenus* and *Clastoptera*. These may be easily separated by the character of the venation of either pair of wings by reference to plate XII.

The *Clastoptera* may be separated from the others, directly, by the rounded apex of the clavus and the terminal membrane of the corium.

CLASTOPTERA.

Germar's original description published in his "Zeitschrift fur Entomologie," Vol. I, p. 157, is as follows:

Kopf gross, stumpf dreieckig, so breit wie der Vorderrucken, Stirn gewolbt, querstreifig, Scheitel breit viereckig, vorn und hinten scharf gerandet, die Nebenaugen auf der mitte des Scheitels genahert. Schnabel bis an die Hinterbrust reichend. Fuhler in einer Grube an der Wurzel der Wangen, sehr kurz, mit langer feiner Endborste. Vorderrucken breit am Scheitel vorgezogen und gerundet, bei den Augen gebuchtet, von den Schultern nach hinten in einer Rundung verschmalert, an der spitze schmal aber tief ausgerandet. Schildchen ein langgezogenes spitzwinkeliges dreieck bildend. Deckschilde lederartig, an der Spitze gewolbt, uber einander klappend, die hintere Randader weit von dem Hinterrande entfernt. Flugel hautig, unter den Deckschilden vorborgen. Beine maszig lang, unbewehrt um die hintersten verlangert, mit zwei stacheln am Rucken die Schienen und einem Dornenkranze an der Spitze der Schienen, und ersten beiden Tarsengliedern.

A careful study of all the American forms leads to the following summary of characters:

Broad, oval forms; very variable in size and color markings; front inflated, circular, not longitudinally carinated; antennæ arising from a deep cavity between the eyes, basal enlargement not extending outside of cavity; vertex narrow, transversely depressed, outline regular, not inclosing front; eyes broad, a row of curved hairs on the outer and posterior margin; pronotum convex, trapezoidal, transversely wrinkled, deeply emarginated behind; scutellum narrow, triangular, longer than pronotum; hemelytra convex, deflected posteriorly, overlapping behind in a perpendicular plane; corium with three apical cells and two widely separated discoid cells, a broad membrane beyond; membrane and apical cellules hyaline; clavus with apex broadly rounded; an oval, convex, callous dot near apex of hemelytra; under wing with a single discoid cell, terminal apical cell open; posterior tibia with a single terminal row of spines: ovipositor carried perpendicular to the plane of the body; males usually smaller and slightly darker than females; smallest varieties nearly black.

Specific characters are based upon the size and shape of front, the facial angle, sculpturing of vertex and pronotum, size and shape of discoid and apical cells, pubescence of pronotum and hemelytra, and the color markings of the face and legs.

Sub-species are based upon size, food habits and associated groups of constant color markings; varieties, on locality, size and color markings of vertex, pronotum and clavus.

SYNOPSIS OF SPECIES.

- A. Front strongly inflated, rising abruptly from face at sides, meeting vertex in same plane; pronotum with broad wrinkles; first discoid cell equal to second.
- B. Front, outline a regular curve, entirely black, or yellow with transverse interrupted brown bands above, light below; pronotum scabrous, with about eight distinct wrinkles; veins on clavus prominent.....*delicata*, Uhl.
- BB. Front, outline an irregular curve, upper half black with a narrow yellow margin next to vertex, lower half yellow, loræ and clypeus yellow; pronotum, bare, with about twelve indistinct broad wrinkles.....*proteus*, Fitch.
- AA. Front, less inflated, rising gradually from face at sides, meeting vertex at an obtuse angle above; pronotum finely, sharply wrinkled, about twenty on the median line; first discoid cell smaller than second.
- B. Hemelytra strongly impunctured, sparsely pubescent; second apical cell short and broad; insects small, of a uniform color above.....*xanthocephala*, Germ.
- BB. Hemelytra minutely impunctured, thickly finely pubescent, second apical cell long and narrow; insects large, usually banded above.....*obtusa*, Say.

ARTIFICIAL KEY TO SPECIES.

- A. Face entirely black.....*delicata-lineata*, var. *b.* or *binotata*.
- AA. Face not entirely black.
- B. Upper half of front black; loræ, clypeus and lower half of front yellow.....*proteus*.
- BB. Upper half of front light with transverse, interrupted, brown bands.
- C. Pronotum with five transverse straight black bands, not parallel with anterior margin.....*delicata-lineata*, var. *a.*
- CC. Bands on pronotum parallel to anterior margin or wanting.
- D. Hemelytra strongly impunctured, sparsely pubescent; pronotum without bands; lower half of face with a light band; insects small.....*xanthocephala*.
- DD. Hemelytra minutely impunctured thickly, finely pubescent; pronotum generally banded or colored where not, face all light; insects large.....*obtusa*.

C. DELICATA UHL.

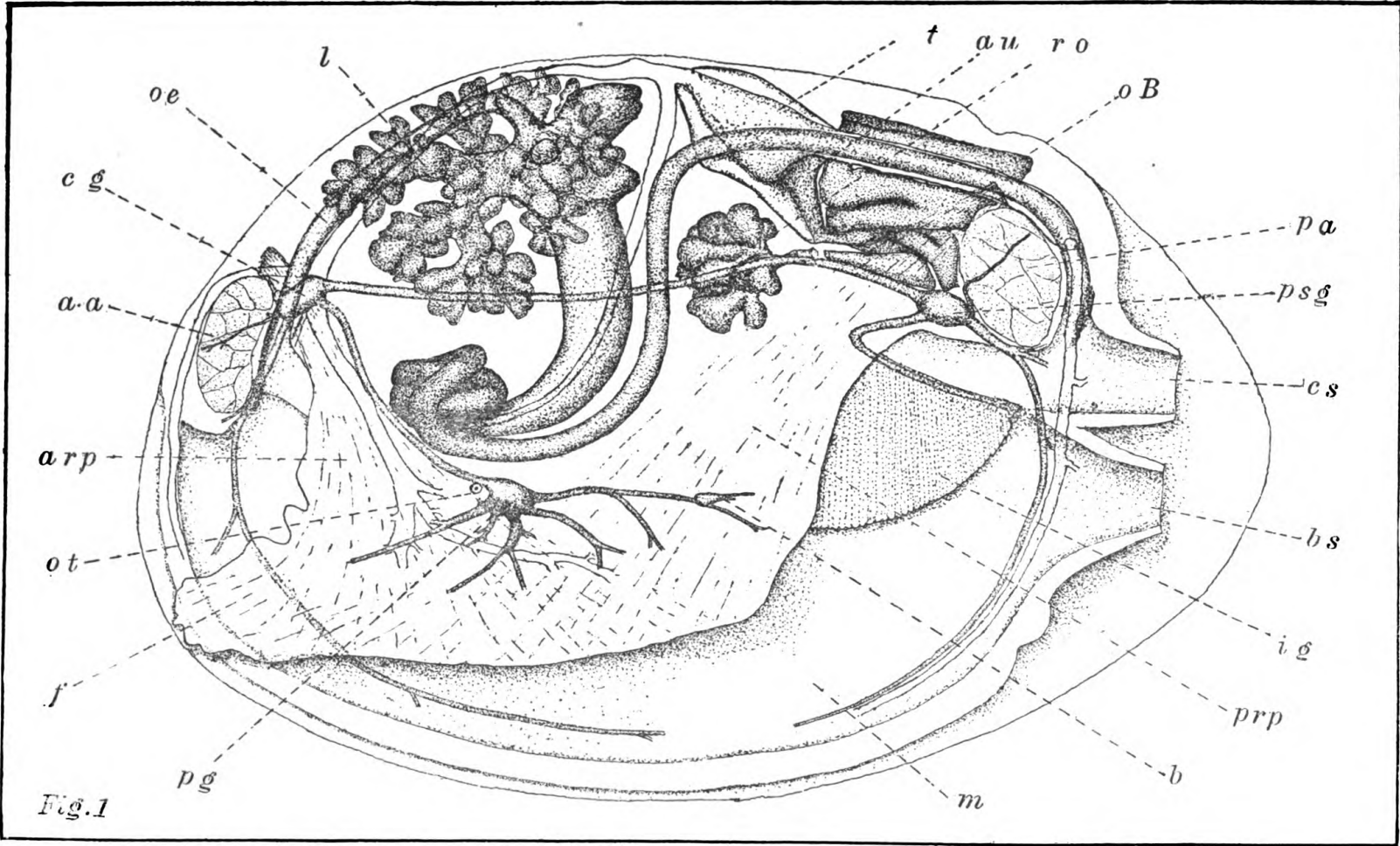
C. binotata Uhl. ms.

Uhler's original description found in his list of Hemiptera west of the Mississippi river is as follows:

Form of *C. proteus*, Fitch, but with a more prominent front. Pale greenish-yellow. Head broad, apparently impunctate; cranium short, transversely depressed, as is also the tylus; anterior edge of the vertex carinately elevated, bordered from eye to eye with a black line; eye margined behind with black; front smooth, polished, bright yellow, rounded, the transverse rugæ substituted by slender black bands; lower down grooved, and with a broad black spot, adjoining which each side on the cheeks is a smaller spot;

PLATE VIII.

IOWA ACADEMY OF SCIENCES, VOL. III.



Gillman A. Drew, del.

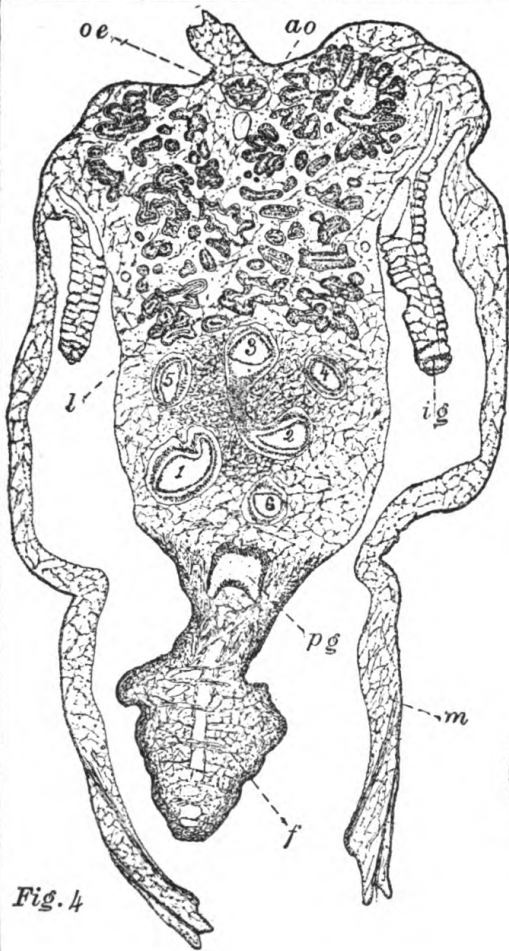


Fig. 4

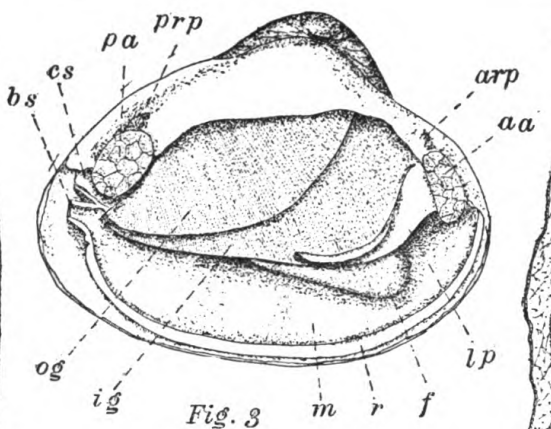


Fig. 3

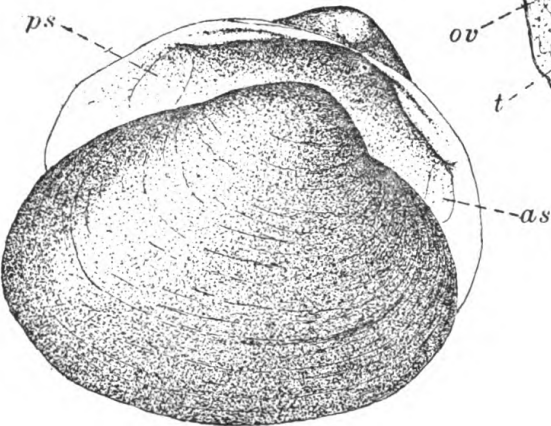


Fig. 2

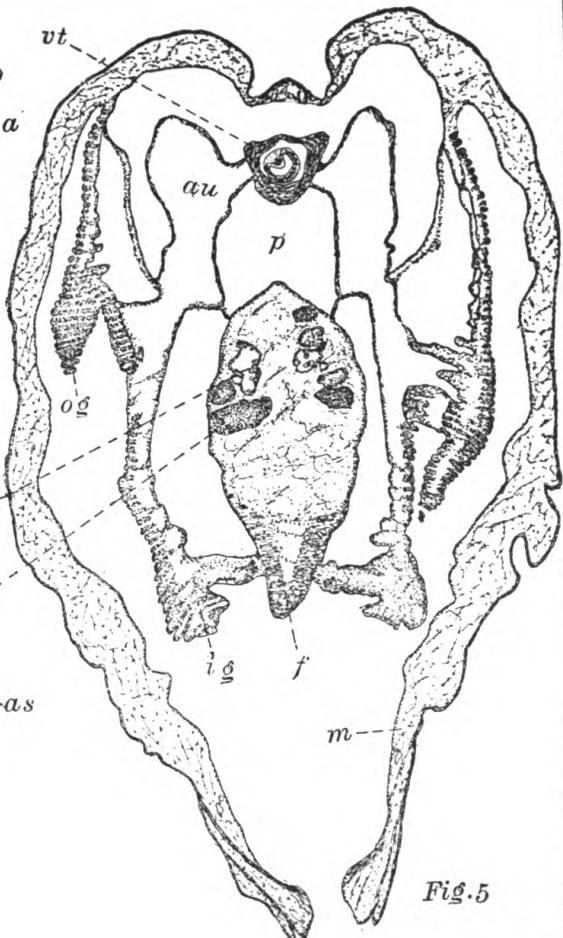


Fig. 5

under side bright yellow; rostrum black, reaching almost to the posterior coxæ; antennæ black at base. Pronotum banded on the anterior margin by a slender black line, and with five straighter and more slender lines which stop just short of the lateral margins, these lines feebly impressed and obsoletely, minutely scabrous, surface not wrinkled, almost smooth, moderately convex, deeply emarginated behind, the lateral margin narrowly produced as far as the outer line of the eyes; the humeral margin recurved, and with a small black dot before it. Scutellum pubescent, yellow, transversely wrinkled, with a slender black line at base, and an interrupted one behind the middle. Hemelytra with short, remote, golden pubescence, coarsely punctate at base, more obsoletely so posteriorly; the inner and posterior margins, the suture between the corium and clavus, an oblique short streak on the disc, and a spot on the middle of the costa fuscous: posterior margin of the corium with a sinuous brown band, the membrane and posterior one-third of the corium, and spot at base of costa pale brown; the bulla very prominent, black; under side yellow; the mesostethium, discs of the plural pieces, and middle line of genital segment pitch black. Legs, yellow, the tibiæ having a band below the knee, another on the middle, and a third at tip, and the spines of tibiæ and tarsi, including the nails, dark piceous.

Length to the tip of hemelytra, four and one-half mm., width of pronotum, two mm.

After a careful study of representatives from every state from which it has been reported so far, the following description, embracing only characters of specific value was prepared.

Size variable; color from yellow to black; front much inflated; two circular yellow depressions on vertex near eyes; pronotum strongly, broadly wrinkled.

Front rising abruptly from face at sides, meeting vertex in same plane above, outline a regular curve. Vertex very slightly transversely depressed; a distinct, circular, yellow depression midway between eye and ocellus on either side. Pronotum coarsely pubescent, strongly, transversely, wrinkled, about eight on the median line. Hemelytra coarsely pubescent; veins on clavus strongly raised; apical cells transversely compressed, third cell triangular, not reaching beyond angle of posterior marginal vein. Legs stout; spurs and spines strong; femur and tibia with dark lateral lines coalescing with two dark spots on outside of tibia.

Sub. sp. I. *lineata*. Pronotum yellow, with five black bands.

Var. a. Clavus with veins and margin yellow inclosing dark areas.

b. Clavus entirely fuscous.

Sub. sp. II. *binotata*. Pronotum entirely black.

Habitat: Utah (Uhl), Cal. Col. and Ariz.

This species is so widely variable that with only the extreme forms there would be no hesitancy in pronouncing them separate species, but with a large amount of material a series can be found which clearly establishes their relationship. Uhler's description is an absolutely perfect one for Sub. sp. *lineata* var.

a, but would apply only slightly to var. *b*, and would absolutely exclude Sub. sp. *binotata*.

C. binotata was a ms. name given to that var. by Uhler, I believe, and under which name specimens have been distributed in collections.

C. PROTEUS, FITCH.

C. saint cyri. Prov.

The original description was published in the fourth annual report of the New York State Museum (1851). Republished in the ninth report of the State Entomologist of New York, page 394, from which the following description and sub-divisions are copied:

Head bright yellow, a black band on anterior margin of vertex and a broader one on the front; front polished, without transverse striæ; a callous black dot near the apex of the elytra; legs yellowish-white, tarsi black. Length, 0.16; males slightly smaller.

Closely allied to the *C. atra* of Germ., but on examining a host of specimens not one occurs in which the legs are annulated with black or fuscous.

He then divides the species up into sub-species and varieties as follows:

Sub. sp. I. *flavicollis*. Thorax entirely yellow.

Var. *a*. Elytra yellow.

b. Elytra with an oblique blackish vitta.

Sub. sp. II. *cincticollis*. Thorax with a black band.

Var. *a*. An interrupted black band on the anterior margin of the thorax.

b An entire black band on anterior margin of the thorax.

c. Thoracic band crossing the disk instead of the anterior margin.

d. Band on the disk of the thorax, and scutellum black.

Sub. sp. III. *maculicollis*. Thorax with one or two discoidal spots.

Var. *a*. A black spot on disk and an interrupted band anteriorly.

b. A black spot on the disk and anterior band entire.

c Two black spots on the disk of the thorax.

Sub. sp. IV. *nigricollis*. Thorax black, with a yellow band forward of the disk.

Var. *a*. The black band on the anterior margin of the thorax interrupted.

b. The band continuous.

c. Scutellum black, with a yellow dot at its base.

d. Scutellum entirely black.

Fitch's "host" of specimens were probably all from one locality and may all have belonged to one sub. sp., according to my classification below. At any rate I have at hand four specimens, that are all clearly and unquestionably varieties of

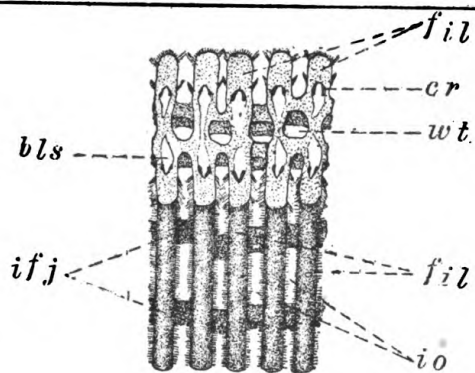


Fig. 6

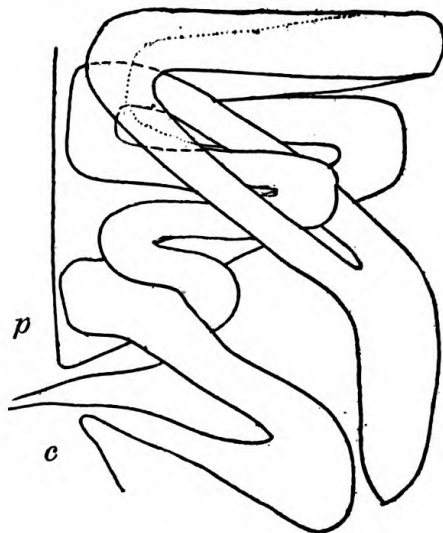


Fig. 7

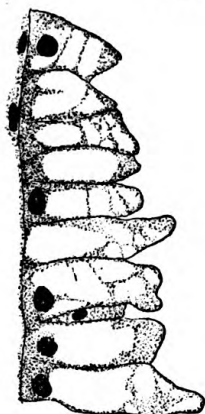


Fig. 11

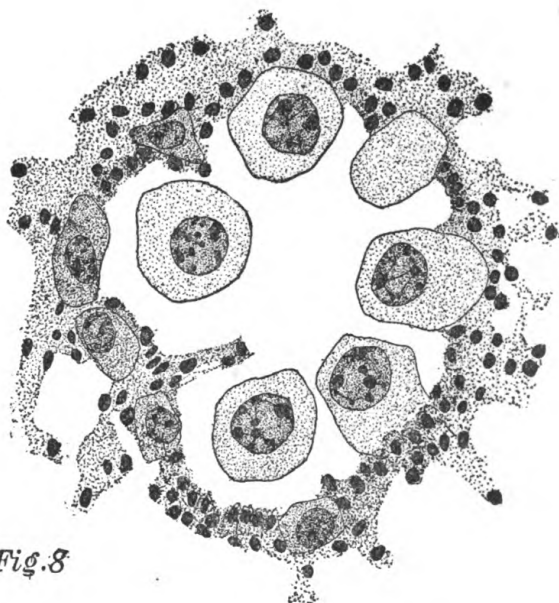


Fig. 8



Fig. 10

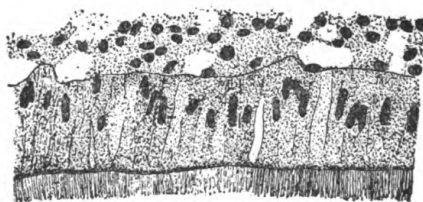


Fig. 9

my sub. sp. *vittata*, each one of which answers the requirements of a different sub. sp. of Fitch; on the other hand I have specimens which are unquestionably of different sub. sp., and occurring in widely separated localities which would be placed in the same sub. sp., and the same variety by Fitch's classification, clearly showing that the color of the pronotum is not of sufficient value on which to base sub-species. He made no provision for the black varieties and from his remark about the relationship of *C atra*, Germ., it is highly probable that he had none.

A careful study of about seventy-five specimens, embracing representatives from widely separated areas resulted in the adoption of the color marking of the clavus as a character constant for a given sub-species, and in the determination of specific characters as follows:

Size, medium; front strongly inflated, upper half black, lower half yellow; legs bright yellow, with lateral black lines.

Front rising abruptly from face at sides continuing in same plane as vertex above; upper half black; lower half, loræ and clypeus yellow, a black dot on center of clypeus. Vertex slightly, transversely depressed, anterior margin not distinctly carinated; suture between front and vertex indistinct. Pronotum bare, broadly, indistinctly, transversely wrinkled, wrinkles minutely striated, about twelve on the median line. Hemelytra with a fine short pubescence; first discoid cell wider than second second apical cell broad, nearly equal to third. Abdomen black or fuscous; legs bright yellow; a lateral line on front of femur, one on each side of tibia; all three joints of tarsi, and last segment of rostrum black. Length, four mm., width of pronotum about one and one-half mm.

Habitat: Iowa, Illinois (Forbes), Quebec, Canada, Ontario, Canada, New Hampshire, Massachusetts, Pennsylvania, New York, District of Columbia, New Jersey (Smith), West Virginia.

Sub. sp. I. *flava*. Anterior two-thirds of clavus yellow.

Var. a. Scutellum with a yellow spot

b. Scutellum black.

Sub. sp. II. *vittata*. Clavus yellow with an oblique black vitta through the middle.

Var. a. Pronotum with one yellow band anteriorly.

b. Pronotum with two yellow bands.

c. Pronotum entirely yellow.

Habitat: New York, Pennsylvania, Massachusetts, Connecticut, District of Columbia.

Sub. sp. III. *nigra*. Clavus entirely black.

Var. a. A yellow band on vertex, and one on face next to vertex.

b. Yellow bands wanting; entirely black above; legs darker.

Habitat: West Virginia, Pennsylvania, District of Columbia, Massachusetts, New York.

Specimens of *C. saint cyri* Prov., that I have from Quebec, Canada, belong to sub. sp. *I. flava*.

C. XANTHOCEPHALA GERM.

Germar's original description (Germ. Zeit. fur die Ento., 1-189) is as follows:

Nigra, capite flavescente, frontis, fascia nigra, elytris maculis marginatibus hyalinis, puncta colloso ante apicum nigro, pedibus pallido-fuscae annulatis.

Habitat in Pennsylvania, Carolina, Zimmermann. One and one-half lin lang. Kopf gelb, um der scheidel dunkel, eine queerbinde auf der unterseite schwarz. Deckschilde schwarz, ein Fleck am vorderrande vor der Spitze, ein anderer, der den ganzen Hinterrand einnimmt, glashell, latzterer mit einem schwarzen schwieligen Punkte vor der Vorderecke. Beine gelblich, braun geringelt.

This species is the most constant in size and coloration of any in the genus. From a study of over one hundred specimens representing every locality mentioned below, I have prepared the following description:

Small, brown or black without markings of any kind above; face with brown bands above, dark below with a distinct light band crossing the center; hemelytra very sparsely pubescent.

Front moderately inflated, light above with about nine transverse interrupted brown bands, band below these, and clypeus black, lorae, included portions of front, and margin of anterior coxal fossæ yellow. Vertex not strongly depressed; suture between vertex and front distinct. Pronotum with about nineteen fine indistinct wrinkles. Hemelytra strongly impunctured, very sparsely pubescent; second apical cell broad, irregularly wedge-shaped. Under side black; legs brown, spurs and spines tipped with black. Length, three and one-half mm., width of pronotum, one and four-tenths mm.

Var. *a.* Black above; a small white spot on center of costa.

b. Glaucus above.

Habitat: Mississippi, Arkansas, Texas, Louisiana, Maryland, District of Columbia, Virginia, Florida, Iowa, Pennsylvania, Carolina (Walker) and New Jersey (Smith).

C. OBTUSA, SAY.

Cercopis obtusa Say. Jour. Acad. Nat. Sci., Phila., IV, 339. (1825.)

Clastoptera achatina Germ. Zeit fur die Ent., I, 189. (1839.)

C. testacea Fitch. Fourth An. Rep. N. Y. State Mus. (1851.)

C. pini Fitch. Fourth An. Rep. N. Y. State Mus. (1851.)

C. lineatocollis Stal. Eng. Resa Omk. jord., IV, 236.

C. osborni Gillette. Hemip. Col., 71. (1895.)

C. stollida Uhl. ?

C. undulata Uhl. ?

Say's original description (Coll. Writings, Vol. II, page 256) is as follows:

Head and anterior part of thorax pale, with three transverse lines; wings varied with brown and pale; body short, oval; head pale yellowish, an elevated, reddish-brown, transverse line between the eyes and before the stemmata; front with about nine parallel, equidistant, reddish-brown lines, which are interrupted in the middle and abbreviated in the cavity of the antennæ; antennæ placed in a deep cavity, beyond which the seta only projects, head beneath black; thorax pale yellowish before, reddish-brown and rugose with continuous lines behind, anterior edge elevated, reddish-brown, a reddish-brown transverse band on the middle; scutel pale reddish-brown; hemelytra varied with fucous and pale, generally forming a band on the middle which is more distinct on the costal margin, spot at tip and larger one at base; nervules dark-brown; feet black, joint whitish; tibiæ and tarsi whitish, posterior tibia bi-spinous behind, of which one is very robust; length rather more than one-fifth of an inch.

The band of the hemelytra is sometimes indistinct, three brown dots near tip; female generally paler, with the abdomen whitish.

This species presents a remarkable number of quite distinct sub-species and varieties, and, owing to the fact that Say's description was of an extreme variety, a great deal of confusion has existed as to its limits, resulting in quite a number of these varieties being described as distinct species. I have appended these descriptions and have retained their names for the sub-species, except *testacea* and *pini*, which I find to be simply varieties of a sub-species of which the description of *osborni* is more nearly true; and it is therefore retained in preference.

The following synopsis of the species is a result of a summary of the different descriptions, and the study of 200 specimens representing every state given below with the exception of New Jersey. I am reasonably confident that with the possible addition of a few more varieties, it will stand the test of any farther discovery of material:

Large; front broad, flattish, with about nine bands above; second apical cell rectangular, elongate; pronotum finely, sharply wrinkled.

Front rising gradually from face at sides, making an obtuse angle with vertex above, upper portion light with about nine parallel, equidistant, transverse, interrupted, brown bands. Vertex very strongly, transversely depressed, carinated anterior margin prominent; suture between vertex and front distinct; ocelli situated near front margin.

Pronotum with about nineteen minute distinct wrinkles. Hemelytra minutely punctured, with a fine thickly set pubescence; second apical cell rectangular, elongate. First, discoid cell curved, narrower than second. Legs stout; spurs, spines and third tarsal segment tipped with black.

Length, four and one-half mm., width of pronotum, two mm.

Sub. sp. I. *obtusa*. Lower half of face fuscous or black.

Var. *a*. Dark; a distinct oblique, light band on hemelytra; pronotum, anterior half, light yellow, divided by a transverse brown band.

Habitat: Iowa, New Hampshire, Massachusetts, New York, Maryland, District of Columbia, West Virginia, Ontario, Canada.

Var. *b*. Light; same markings as above, only much lighter and less distinct.

Habitat: Iowa, New York, District of Columbia.

Var. *c*. Dark; hemelytra coppery; thorax without band; pronotum yellowish (*achatina*).

Habitat: Pennsylvania.

Sub. sp. II. *lineatocollis*. Lower half of face dark with a light band crossing the middle.

Var. *a*. Pronotum entirely dark; scutellum yellow; legs light with lateral dark lines. California.

b. Pronotum, posterior half dark, anterior half sulphur yellow; lines on femur and tibia broad, almost confluent. Colorado.

c. Pronotum light yellow, narrow brown band anteriorly; legs light, lateral line faint; dark band on clypeus reduced to a dot; hemelytra pale rufous, nervules brown, very distinct West Virginia, District of Columbia.

d. Pronotum entirely sulphur yellow; hemelytra dark coppery; legs brown. Maryland, District of Columbia.

Sub. sp. III. *osborni*. Face entirely light, bands on front obscure.

Var. *a*. Light olive green; scutellum sulphur yellow. Colorado, Wisconsin, West Virginia, District of Columbia.

b. Copper colored throughout (*testacea*). New York, West Virginia, District of Columbia, New Jersey.

c. Black; posterior margin of vertex, anterior margin of pronotum, costal margin of hemelytra, and legs yellow. (*Pini*) North Carolina, District of Columbia, New York (Fitch).

The following original descriptions may assist in recognizing the corresponding sub. sp. and varieties. Var. *a*, under each sub. sp., being its type, and of course the only one to which the description will entirely apply.

C. achatina.—(Germ. Zeit. für Ento. Vol. I., 167.) Testacea, fronte nigra, elytris ante apicem fuscis, macula submarginali ante apicem nigra, femoribus medio fuscis. Hab. in Pennsylvania, Zimmermann. Two bis 2½ lin. lang, rothgelb oder grau gelb, stirn und Mittlebrust, bisweilen auch der Hinter-theil des Bauches schwarz. Deckschilde von der mitte weg bis vor die Spitze Schwarzlichbraun, doch bleibt ein Fleck am Seitenrande hell. Die Ader des vorderrandes führt vor ihrer Spitze einen schwarzen Fleck.

C. lineatocollis. Stal. (Eng. Resa, Omk. jord. IV, 286) Caput dilute flavescens, verticils marginibus basali et apicali lineisque transversis frontis apicem versus longitrorsum impressæ nigrofuscis. Thorax postice

profunde angulatosinuatus, medio longitrorsum carinatus dilute flavescens, lineis pluribus transversis fuscis ornatum. Tegmina latitudine vix duplo longiora, sordide flavescence-pellucida, medio fascia antrorsum angustata et abbreviata albida, anteriore a linea, posticea fascia indistincta fuscis terminata, callo rotundato fere apicali ad marginem costalem nervisque apicalibus hic illic fuscis. Subtus nigro-varia. Pedis dilute flavescentes, vitta femorum maculisque tibiarum nigro-fuscis.

C. osborni Gillette. (List Hem. Col. p 71) Female: face two-thirds wider than long, minutely, indistinctly sculptured; clypeus broad at base, gradually tapering to the pointed apex, one-fifth longer than broad, basal suture obsolete; loræ long, nearly as long and half as broad as clypeus; genæ narrow, outer margin concave beneath eyes, convex below loræ where they are very narrow, touching the clypeus at the broadest part; front but little longer than broad, superiorly very broadly and evenly rounded. Vertex very slightly transversely depressed, anterior margin carinately elevated, not longer at middle than at eyes. Pronotum transversely wrinkled, minutely scabrous, two distinct pits behind anterior margin near the median line, three-fourths wider than long, anterior curvature three-eighths of length. Scutellum finely and transversely wrinkled and minutely scabrous, longer than head and pronotum, twice longer than wide. Elytra with a fine, thickly set, golden pubescence, entirely finely, densely punctured. Color pale rufous throughout, tinged with olive green on pronotum and clavus, beneath more yellowish. Length, five and one-half mm. Described from two females. Large but somewhat narrower across the hemelytra than is usual in this genus.

C. testacea Fitch. (Ninth Rep. St. Ento. N. Y., 393.) Testaceous; scutellum rufous; elytra with a polished callous-like black dot near the apex. Length, 0.20 inches.

C. pini Fitch. (Ninth Rep. St. Ento. N. Y., 393.) Black; head yellow, with a black band on the anterior margin of the vertex; thorax with a yellow band anteriorly; elytra with a broad hyaline under margin interrupted in the middle and a black callous dot near the apex. Length 0.14.

NOTE—I have been unable to obtain specimens of *C. undulata* and *C. stolidus* of Uhler from the West Indies, but from their descriptions I am very confident that they will be found to be varieties of *obtusa* also. So that, with the possible exception of *C. brevis*, Walker, this paper includes all the present known or described forms of the North American *Clastoptera*.

GEOGRAPHICAL DISTRIBUTION.

Quite a number of interesting facts have been brought to light through a comparative study of geographical distribution. Each species possesses a wide range, while some of the varieties are exceedingly sectional in their distribution. As a whole *obtusa* has the greater range, occurring from Massachusetts to California, and from Canada to Georgia, and probably to the West Indies. Sub-sp. I, *obtusa* is the most common form in the east and the only one found in the Mississippi valley,

while of sub-sp. II, *lineatocollis*, var. *a* and *b* occur only in California, Arizona and Colorado, and var. *c* and *d* have only been reported from Maryland and West Virginia. Sub-sp. III *osborni*, var. *a*, has a wide range, while var. *b* (*testacea*) and *c* (*pini*) are only found on the eastern coast from New York to North Carolina.

C. proteus, sub-sp. I, *flava*, is found throughout the northern half of the Mississippi valley and the eastern states up to Canada, while sub sp. II and III, *vittata* and *nigra*, are found only in Pennsylvania and the surrounding states. Both varieties of *xanthocephala* have the same wide range: the southern part of the United States, from Maryland to Iowa on the north to Florida and Texas on the south. *C. delicata* with all of its varieties ranges from Colorado to California, and from Utah to Arizona.

ECONOMIC IMPORTANCE.

As a whole they are of considerable economic importance. Although not usually occurring in sufficient numbers to be noticeably injurious, however, *proteus* has been reported as having done considerable damage to cranberry swamps in a number of instances. Their food habits have not been very accurately determined. In general they feed on the sap of trees and shrubs, occurring most abundantly in low places. They have been reported as occurring on the ash, oak, pine, alder, butternut, elder, blueberry, cranberry and some of the larger grasses and weeds.

SUMMARY.

The study of this genus just recorded only adds one more instance to the many giving evidence against the immutability of species. Here we have four species, of which the larger and lighter varieties are widely separated, and easily recognizable by constant and strikingly distinct color markings, while at the other end of the series are small dark forms only capable of separation and recognition by reference to structural characters rendered indistinct by deep coloration. To still more complicate matters, *proteus* excepted, they have intermediate light green or glaucous forms which so grade into each other in size and shade that it is only on structural characters in general, and the shape of the apical cells, in particular, that they can be separated.

The structural characters upon which the species have been founded have proved so constant, within measurable variations, for all the different varieties, that I am confident the species and the synonymical determinations will stand. The limitation of sub-species and varieties, while as accurate and complete as the 400 specimens of available material would allow, will doubtless undergo some expansion and correction with the accumulation of new and larger collections of material.

In conclusion I wish to acknowledge indebtedness to Messrs. Gillette, Lintner, Ashmead, Weed, Fernald, Goding, Skinner, Van Duzee, Sirrine, Mally and Gossard and Miss Beach for the privilege of examining material, and for other favors extended, and to Professor Osborn, in particular, for the use of his private collection and the department material, and for his invaluable counsel and advice.*

EXPLANATION OF PLATES.

PLATE XI.

Figure 1. *Clastoptera obtusa*, Say.

Color markings of Sub-species I. *obtusa*.

Showing color markings of faces.

Figure 2. *C. obtusa-obtusa*.

Figure 3. *C. obtusa-osborni*.

Figure 4. *C. obtusa-lineatocollis*.

Figure 5. *C. proteus-nigra* (variety b.).

Figure 6. *C. proteus* Fitch.†

Figure 7. *C. xanthocephala* Germ.

Figure 8. *C. delicata-lineata* (variety a.).

PLATE XII.

Venation of upper and under wings represented by one species from each genus as a type. The venation seems to be very constant within generic limits, as far as I have had opportunity to examine, with the exception of *Philænus* which either possesses two types or else there is another as yet unrecognized genus represented in our fauna.

Figure I. Wings of *Monecphora bicincta*, Say.

Figure II. Wings of *Philænus* sp.

Figure III. *Lepyronia 4-angularis* Say.

Figure IV. *Aphrophora quadrinotata*, Say.

Figure V. *Philænus* sp. *

Figure VI. *Clastoptera obtusa*, Say.

* This work has been done in the entomological laboratory of the Iowa Agricultural College, and submitted as a graduating thesis.

PLATE XIII.

- Figure 1. Leg of *Aphrophora quadrinotata*, Say, showing double row of spines.
Figure 2. Leg of *Lepyronia quadrangularis*, Say.
Figure 3. Leg of *Clastoptera proteus*, Fitch, showing single row of spines.
Figure 4. Side view of *C. delicata*, Uhl., showing outline of face. Oblique dorsal view of same showing inflation of front.
Figure 5. *C. proteus*, Fitch, same as above.
Figure 6. *C. xanthocephala*, Germ.
Figure 7. *C. obtusa*, Say.
Figure 8. Venation of hemelytra, *C. delicata*.
Figure 9. Same for *C. proteus*.
Figure 10. Same for *C. xanthocephala*, Germ.
Figure 11. *Clastoptera obtusa*, Fitch.
1, 2 and 3; first, second and third apical cells, a and b; first and second discoid cells.

PLATE XIV.

- Figure 1. Abdomen of *Lepyronia quarangularis* Say, male, ventral view.
Figure 2. Female, of same.
Figure 3. Male, dorsal view.
Figure 4. Abdomen of *Aphrophora parallela*, Say, male, ventral view.
Figure 5. Female, ventral view.
Figure 6. Same, dorsal view.
Figure 7. Abdomen of *C. obtusa*, male, posterior view.
Figure 8. Female, same view.
Figure 9. Abdomen of *C. xanthocephala*, Germ., male, posterior view.
Figure 10. Female, same view.

OBSERVATIONS ON 'THE CICADIDÆ OF IOWA.

HERBERT OSBORN.

The members of this interesting group of insects, which contains the largest of our native Homoptera, have at least four representatives in the state of Iowa and it is the intention to call attention to these in this paper and also to put on record some observations regarding their habits and distribution which may serve as a basis for further investigations concerning them.

Cicada dorsata Say. One specimen of this large species in the collection of the Iowa Agricultural College from a student who stated that it was taken in Poweshiek county, is the only example indicating its occurrence in the state.